Title: Linear modeling and Predictions: How warm is too warm?

Course Learning outcomes:

- Write the equations of lines given either two points or a point and a slope
- Solve word problems involving proportions and other linear equations in one variable, quadratic equations that can be solved by factoring, rational equations, and systems of linear equations in two variables.

Assignment Learning outcomes:

- Students will learn how mathematical models are used to make trendlines and predictions.
- Students will better understand the meaning of slope.
- Students will learn to think critically about data on social phenomena, share their point of view and support their ideas.

Methods of assessment:

In class, I will have students work in groups on the first set of questions. They will write up their work on large poster paper that we will place up on the walls.

I will have students fill out a KWL at the end of the class as a formative assessment. If students express wanting to learn more about the topic, I will do my best to bring in additional information.

Quiz and exam questions will ask students to interpret the meaning of slope. Additionally, I will provide students with data where they would have to find the equation of the trendline and use their function to make predictions and think critically about the data.

Possible Quiz Question:

![Coal Consumption Graph]

Coal Consumption (quads)

<table>
<thead>
<tr>
<th>Year</th>
<th>Coal Consumption (in quads)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>0.000</td>
</tr>
<tr>
<td>1970</td>
<td>5.000</td>
</tr>
<tr>
<td>1975</td>
<td>10.000</td>
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<td>1980</td>
<td>15.000</td>
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<tr>
<td>1985</td>
<td>20.000</td>
</tr>
<tr>
<td>1990</td>
<td>25.000</td>
</tr>
<tr>
<td>1995</td>
<td>30.000</td>
</tr>
</tbody>
</table>

Year
Study the graph above **Coal Consumption** containing data from the U.S. Energy Administration. The unit of measure here is quads, a standard measure standing for quadrillion BTUs. (BTU = British Thermal Unit, a unit of energy.)

a. (2 pts) What are two ordered pairs that are on the line?

b. (5 pts) Use the two points above to come up with an equation for the line that models the data provided.

c. (3 pts) Predict the coal consumption in the year 2015. How confident are you in this prediction? Why?

d. (2 pts) According to your model, when will the coal consumption be 40 quads?

e. (2 pts) How confident are you in the above prediction? **What are some social, political, or physical factors that could affect the accuracy of this prediction?** Would these factors increase or decrease coal consumption in the future?
The Lesson:

- I will plan on using this next semester. If possible, I might introduce the lesson with a short video on global warming, then have students share what they think about it, whether they believe it is happening, and whether they believe it is significant.
- This unit will introduce Chapter 8 on Functions and their graphs. The chapter begins with a review of linear functions and it is important that students know how to find the equation of a line given two points and how to use function notation to substitute in values for both the dependent and independent variables.
- The lesson will be an in-class group activity. Students will not be graded for their in-class work, only for the homework questions which will count as a regular homework. I will walk around during group work time to ask follow up questions, answer questions and ensure that students are thinking critically about the questions.

1. Study the graph above from the site: [Linear trendline graphs](#)

2. As a group, pick two data points that are on each line (red, blue, orange and yellow). Divide the four lines among your group and have each person determine the equation of their line. Write the equation of the lines in slope intercept form (i.e. solve for y). Have each person pass their work to at least one other person in the group to check their work.

3. Use each of your equations to predict what the global mean temperatures will be in the year 2050 and 2100.

4. As a group, decide which line you believe would provide the most accurate predictions based on current events and trends? Explain your reasoning.

5. Put the two points and the equation of the chosen line on your group's poster.

6. Use the equation of the line you preferred in question 4 to predict by what year the global mean temperature will be 17 degrees Celsius. Does this seem reasonable to you? Why or why not? Put these results on your poster as well.

7. What is the meaning of the slope in each of the four equations?

**Homework**
1. In class, your group discussed the meaning of the slope of each of the four equations. Note that each line as you move to the right, is considering a shorter but more recent period of time. Compare the slopes. What do these changes in the slope mean?

2. Why do you think it is increasing? Do you believe it is a problem?

3. Read the information on global temperature increase and the significance/consequences of each degree Celsius increase. [http://globalwarming.berrens.nl/globalwarming.htm](http://globalwarming.berrens.nl/globalwarming.htm) Is a one degree increase considered significant? What do you consider significant?


5. What do you think can/should be done to reduce the rate at which the global temperatures are increasing?